California Fig Advisory Board

PROJECT REPORT

Project Year: 2006

Anticipated Duration of Project: 2 years

Project Title: Assessing Commercial Potential of Diverse Fig Cultivars

Project Leaders:
1. Ed Stover, Research Leader, USDA Germplasm Repository, Davis, CA 95616, Telephone: 530-752-7009/6504, Email: ewstover@ucdavis.edu
2. Carlos Crisosto, UC Davis, Kearney Ag. Center, Parlier, CA 93648, Telephone: 559-646-6500, Email: <carlos@uckac.edu>

Cooperating Personnel:
1. Louise Ferguson, UC Davis, CA 95616, Telephone: 530-400-6773, Email: <louise@uckac.edu>
2. Malli Aradhya, Geneticist, USDA Germplasm Repository, Davis, CA 95616, Telephone: 530-752-9392/6504, Email: <aradhya@ucdavis.edu>
3. Howard Garrison , Agricultural Research Technician, USDA Germplasm Repository, Davis, CA 95616, Telephone: 530-752-6504, Email: < hggarrison@ucdavis.edu>

Project's Benefit to Fig Industry

Identify cultivars suitable for fresh fig production, distribution and sales. This will provide an expansion of the existing, largely dry fruit and processing market, and should realize improved returns to growers.

Objectives

1. Determine leafing, cropping and fruiting characteristics of 24 fig cultivars selected as having promise or are industry standards.
2. Characterize fruit quality traits both with and without caprification.
3. Prepare and publish data collected for use by the California Fig Advisory Board.
4. Identify and acquire additional fig cultivars which may contribute to the California fig industry.

Shoot development on selected accessions in fig collection at NCGR in Winters, CA

Shoot development was assessed weekly, beginning in early April. Blanquette, Violette de Bordeaux, Excel and Flanders were among the earliest budding varieties, and were about a week ahead of kadota. Snowden, Sucrette, Vernino, Brunswick, and Zidi were among the latest to bud, being fully three weeks behind the earliest varieties.

Breba crop production

Production of the breba crop was assessed on the entire bearing collection. Except for 'Santa Cruz White' , 95% of brebas ripened between June 25 and July 10. Of 108 edible cultivars, only 10 accessions produced more than 20 brebas on any single tree and only 4 accessions (King, Santa Cruz White, 135-15s, UCR 291) ever produced more than 2 brebas on a single branch. No

tree of 63 accessions produced a single breba. As in 2005, King was the most breba-productive variety with an average of 6 brebas per branch and more than 200 brebas per tree. A variety which was not included in last year's evaluation, 'Santa Cruz White' essentially equaled 'King' in breba production, but was somewhat earlier. This is a very unusual variety which is essentially an edible caprifig with androecium expression varying markedly between different fruit on the same tree. It may be of interest as a parent for developing a highly breba-productive variety. 'Dauphine' and '135-15s' produced more than 80 brebas on only one of the two trees of each accession 9the same trees produced brebas last year), While 'UCR-291', '319-1' and 'Black Fig 1' produced around 50 brebas on a tree.

Only nine cultivars had sufficient breba fruit ripe at any time to warrant fruit quality assessment. King fruit were similar in size to the 2005 fruit, a mean of 56 grams (57 grams in 2005). The largest varieties from 2005 (120 grams per fruit in Brown Turkey and 106 in Orphan) did not produce sufficient fruit for analysis in 2006. Dauphine was the largest analyzed at 69 gram per fruit. Brix was assessed on the juice from the pulp and homogenized entire fruit with very similar results. Mission, Diredo, Black fig 1 and Violette de Bordeaux were the only varieties which exceeded 20 Brix.

Maturity in caprifigs

Maturity in each accession of our caprifig collection was gauged weekly from May 11 through July 14. Virtually every accession reached full maturity on June 23-30. A heat wave during this period may have compressed maturity. Capri A, Capri B, Capri Z, Roeding 3, and KAC 11- 7W were the earliest maturing with 90-95% ripe on June 23. A few accessions still had sound fruit on July 7: Roeding 4, 'Milco', Persistent Capri 228-20, 66-31, and DFIC0164.1 .6 and .7 (a wild collected accession). One "caprifig", Capri Q, produces no profichi crop.

Data were collected on Caprifig size, color, rot and presence of wasp, but have not yet been evaluated.

Effect of caprification

Insect-tight bags were prepared using nylon cloth with a 0.0105 x 0.0322 inch mesh. Three branches were bagged on each tree of the 42 in the study group in late May. On each tree, matched branches were identified that were not bagged. On August 28, 2006, data were collected on fruit number and characteristics on the caprified and non-caprified fruit.

Most cultivars behaved as expected. There were a few surprises. As in 2005 ruit set in King appeared to be unaffected by wasp exclusion, even though it is considered a San Pedro type. Also as in 2005, Zidi (which is considered a Smyrna type) produced a few sound fruit on the bagged limbs: these had no seeds and had excellent quality. This suggests that Zidi may merit experimentation with plant growth regulator treatments if production without caprification is desired. Several varieties considered common-types had lower fruit set in the bags. Most notable were Golden Celeste and Celeste. 'Blanquette' behaved as a Smyrna type as did several UC Riverside selections: 152-4s and 135-4s.

Early maturity and overall cropping in the entire fig collection

Weekly beginning 8/8/06, the entire fig collection was scored for commercially mature (well colored) fruit. Santa Cruz Dark, Orphan, Giant Amber and Yellow Neches had the largest numbers of ripe fruit early, as in 2005. Pastiliere, Celeste, Yellow Neches, and Genoa had the highest proportion of fruit ripe in the first 3 weeks with 65% or more of total fruiting occurring in this period. , but overall cropping was light (Table 6). Among the standards, Brown Turkey had the largest number of ripe fruit, at 215 per tree in the first 3 weeks, representing 50% of the total crop.

Susceptibility to bruising in white figs

Research committee members stressed the importance of identifying a white cultivar with resistance to bruising. 41 fig cultivars and selections were assessed in Dr. Carlos Crisosto's lab, using two methods of assessing bruising. Fruit were dropped 30 cm using a device designed to ensure uniformity and other fruit of each accession were pressed using a fruit texture analyzer equipped with a 4 mm diameter flat tip. For each accession, initial fruit firmness was assessed and then shelf life was determined after 7 days at 0°C and 1, 2 and 3 days of additional storage at 20°C. Data collected in the shelf-life study included:

- Percent of sound fruit (commercial fruit)
- Percent of fruit with decay
- Percent of fruit with beginning of decay (without mycelium)
- Percent of fruit with off color (color not typical for the cultivar)
- Percent of fruit with growth cracks
- Percent of fruit with splits
- Percent of fruit with juice on the ostiole
- Percent of fruit with other blemishes

Cultivars/selections with less bruising (less than 30% of fruit affected) after 3 days at 20°C were: '184-15', '187-25', 'Golden Celeste', 'Kadota 1', 'Sel 326-1', 'Sel 337-2', and 'White Texas Everbearing' when exposed to either impact or pressing bruising. Cultivars/selections with more bruising (more than 50% of fruit were affected) after 3 days at 20°C were: '143-28', '143-38', 'Sel K-7-11', 'UCR 309-B-1' when exposed to either impact or pressing bruising.

Cultivars/selections with less decay after 3 days at 20°C were: '184-15s', 'Sel 233-10', and 'UCR 278-128' when exposed to impact bruising (7.14% of fruit decayed), and '184-15s', 'K 6-5', '200-43', and 'Sel 315-1' when exposed to pressing bruising, which did not presented any fruit with decay. Cultivars/selections with more decay (more than 60% of fruit decayed) after 3 days at 20°C were: '135-4s', '143-38', 'Dfic 164-09', 'Golden Celeste', and 'UCR 309-B-1' when exposed to impact bruising, and '143-28', '143-36', '143-38', 'Ischia White', and 'Snowden' when exposed to pressing bruising.

Fruit quality in main crop

Fruit from 15 varieties were collected on 9/11/06, selecting tree ripe fruit (neck sagging slightly) and commercially ripe fruit (well colored, but not sagging). Twenty fruit per tree were harvested in each category. These fruit were transported to Kearney Ag center and were analyzed for a wide variety of quality-related parameters in Dr. Carlos Crisosto's lab. The firmest fruits were those of Panachee at commercial ripeness. Orphan had the greatest firmness for tree-ripe fruit..

The fruits of Zidi and UCR 135-4s were the largest at 50-54 grams but Brown Turkey fruit were only half the size of the same variety in 2005 at 28 grams.

Ethylene and respiration levels indicate that the climacteric occurs before commercial maturity. This may have significant implications for postharvest handling, as this indicates that fruit are essentially on the down-slope of senescence when they are coloring. Soluble solids (SSC) varied widely. As in 2005 Orphan had the lowest SSC, both at commercial maturity and when tree-ripe but Brown Turkey was much higher in SSC than in 2005. Mission, Verdal Longue, Panachee, White Texas Everbearing, 135-4s, and Zidi where in the highest SSC category. Panachee, UCR 291, and Mission had the highest titratable acidity.

Postharvest quality in main crop

Fruit from the same 15 varieties were at both tree ripe (sagging slightly) and commercially ripe (well colored, but not sagging) were subjected to post-harvest storage analysis. Twenty fruit per tree were harvested in each category. These fruit were transported to Kearney Ag center in Dr. Carlos Crisosto's lab. For each accession, shelf life was determined after 7 days at 0°C and 1, 2 and 3 days of additional storage at 20°C. Data collected in the shelf-life study included (Table 1):

- Percent of sound fruit (commercial fruit)
- Percent of fruit with decay
- Percent of fruit with beginning of decay (without mycelium)
- Percent of fruit with off color (color not typical for the cultivar)
- Percent of fruit with growth cracks
- Percent of fruit with splits
- Percent of fruit with juice on the ostiole
- Percent of fruit with other blemishes

The highest percentage of sound fruit, at each time-point, was observed in 'Gulbun' (284-11): 98% of fruit were marketable after 7 days at 0°C and 46% remained sound after 3 more days at 20°C. 'Mission' was the best-performing standard cultivar, with almost identical performance, while 'Brown Turkey' and 'Kadota' had 76-78% of fruit were marketable after 7 days at 0°C and 11-20% remained sound after 3 more days at 20°C. 'Zidi' perfoemed more poorly than in 2005, with 93% of fruit marketable after 7 days at 0°C but only 11% remained sound after 2 or 3 more days at 20°C.

Late maturity

Across the entire collection, Verdal Longue, Vernino, and several UC Riverside selections were notable for having many fruit late in the season. Verdal Longue and Vernino still had many ripe and unripe fruit in December after all leaves were dropped, and merit interest for late season production where the growing season could be extended.

Percentage defoliation was measured at several dates in the fall. It is well known that Ficus pumila is not well-adapted to temperate climates and only 60% defoliation was observed in mid December. Many UC Riverside accessions were among the slowest edible figs to defoliate. 143-28 had only ~8% defoliation on November 1 and 95% on December 1. Conadria and

Vernino were the slowest named cultivars to enter dormancy as measured by leaf drop. Golden Celeste and White Texas Everbearing were among the earliest accessions to enter dormancy.

Acquiring new cultivars which merit attention from the California fig industry

We have been networking with fig researchers from around the world and continue to exchange germplasm resources. Over the last two years a total of 108 named fig cultivars have been added to the NCGR collection, increasing our collection from 190 to 298 accessions. In testing using our newly perfected fig DNA fingerprinting some appear to be synonymous with cultivars previously collected. Only a few of these new accessions are likely to have potential commercial value, while others may contribute to future cultivar development and better understanding and control of commercially important genes and physiological traits.

DNA fingerprinting

To date, 182 of our accessions have been fingerprinted using SSRs (simple Sequence Repeats, a DNA feature that is inclined to slightly higher mutation rates and is also the key to forensic DNA testing) at 12 loci. A pictorial representation of relatedness is presented in Figure 1. This permits better management of our collections, assessment of genetic diversity and relatedness, inferences on parentage, and unique identification of each genotype.

Table 1. Firmness and quality of 15 fig cultivars immediately after storage at 0°C and the first 3 days at 20°C (shelf life).

Cultivar	Maturity	Days at 20C	Firmness (lb)	Sound (%)	Decay (%)	Beginning decay (%)	Off Color (%)	Growth Cracks (%)	Splits (%)	Juice on ostiole (%)	Blemishes (%)
Gulbun Selection 284-11	Commercial	0	1.57	98.15	0.00	0.00	0.00	5.56	0.00	0.00	1.85
		StdDev	1.14	3.21	0.00	0.00	0.00	5.56	0.00	0.00	3.21
		1		77.78	1.85	7.41	1.85			0.00	5.56
		StdDev		0.00	3.21	8.49	3.21			0.00	5.56
		2	0.75	48.15	1.85	37.04	3.70			1.85	7.41
		StdDev	0.34	3.21	3.21	6.42	3.21			3.21	3.21
		3		46.30	5.56	42.59	7.41			3.70	7.41
		StdDev		3.21	5.56	3.21	3.21			3.21	3.21
Gulbun Selection 284-11	Tree Ripe	0	0.34	21.93	0.00	5.36	27.49	36.45	0.00	5.56	12.48
		StdDev	0.06	6.00	0.00	5.27	10.13	6.98	0.00	9.62	11.99
		1		16.37	3.51	5.36	27.49			7.41	19.88
		StdDev		5.58	6.08	5.27	10.13			8.49	12.43
		2	0.32	1.85	38.11	23.59	38.40			7.41	25.44
		StdDev	0.08	3.21	9.02	6.04	15.26			8.49	13.91
		3		0.00	45.03	33.04	38.40			12.87	29.14
		StdDev		0.00	20.26	15.20	15.26			8.61	8.69
Mission	Commercial	0	0.69	98.15	0.00	0.00	0.00	11.11	0.00	0.00	1.85
		StdDev	0.14	3.21	0.00	0.00	0.00	11.11	0.00	0.00	3.21
		1		88.89	3.70	0.00	1.85			1.85	5.56
		StdDev		9.62	3.21	0.00	3.21			3.21	5.56
		2	1.03	62.96	11.11	11.11	3.70			1.85	9.26
		StdDev	1.21	8.49	5.56	0.00	6.42			3.21	8.49
		3		44.44	24.07	9.26	5.56			5.56	9.26
		StdDev		9.62	17.86	6.42	9.62			5.56	8.49
Mission	Tree Ripe	0	0.29	38.89	0.00	1.85	0.00	12.96	0.00	0.00	5.56
		StdDev	0.10	9.62	0.00	3.21	0.00	3.21	0.00	0.00	9.62
		1		37.04	11.11	1.85	1.85			0.00	5.56
		StdDev		8.49	11.11	3.21	3.21			0.00	9.62
		2	0.32	18.52	33.33	9.26	1.85			5.56	5.56
		StdDev	0.11	6.42	14.70	3.21	3.21			5.56	9.62
		3		12.96	57.41	14.81	3.70			11.11	5.56
		StdDev		3.21	6.42	11.56	3.21			14.70	9.62
White Texas Everbearing	Commercial	0	0.64	31.48	14.81	20.37	5.56	0.00	0.00	37.04	0.00
		StdDev	0.36	25.05	16.97	8.49	9.62	0.00	0.00	3.21	0.00
		1		0.00	25.93	38.89	11.11			64.81	7.41
		StdDev		0.00	30.60	14.70	11.11			25.05	8.49
		2	0.47	0.00	38.89	48.15	11.11			70.37	11.11
		StdDev	0.10	0.00	36.43	23.13	11.11			25.05	14.70
		3		0.00	72.22	27.78	48.15			72.22	11.11
		StdDev		0.00	16.67	16.67	6.42			22.22	14.70
White Texas Everbearing	Tree Ripe	0	0.50	20.37	1.85	42.59	1.85	3.70	0.00	31.48	9.26
		StdDev	0.10	12.83	3.21	13.98	3.21	6.42	0.00	21.03	8.49
		1		7.41	20.37	48.15	5.56			35.19	11.11
		StdDev		6.42	6.42	3.21	5.56			19.51	11.11
		2	0.40	0.00	57.41	38.89	5.56			55.56	11.11
		StdDev	0.07	0.00	16.04	19.25	5.56			9.62	11.11
		3		0.00	74.07	24.07	12.96			57.41	14.81
		StdDev		0.00	6.42	3.21	8.49			12.83	6.42

Cultivar	Maturity	Days at 20C	Firmness (lb)	Sound (%)	Decay (%)	Beginning decay (%)	Off Color (%)	Growth Cracks (%)	Splits (%)	Juice on ostiole (%)	Blemishes (%)
Brown	Commercial	0	1.21	77.78	0.00	0.00	7.41	1.85	0.00	0.00	12.96
urkey		StdDev	0.71	5.56	0.00	0.00	3.21	3.21	0.00	0.00	8.49
		1		77.78	3.70	0.00	7.41			1.85	14.81
		StdDev		5.56	6.42	0.00	3.21			3.21	8.49
		2	0.57	53.70	5.56	24.07	11.11			5.56	18.52
		StdDev	0.18	11.56	5.56	8.49	5.56			5.56	11.56
		3		20.37	42.59	12.96	16.67			5.56	22.22
		StdDev		8.49	8.49	8.49	9.62			5.56	11.11
Brown Turkey	Tree Ripe	0	0.33	17.10	0.00	0.00	18.74	0.00	0.00	11.33	22.77
		StdDev	0.12	6.22	0.00	0.00	8.20	0.00	0.00	5.57	15.03
		1		11.55	16.99	7.52	20.59			11.33	22.77
		StdDev		10.38	5.58	3.12	8.13			5.57	15.03
		2	0.25	3.81	33.99	17.21	20.59			13.29	22.77
		StdDev	0.05	3.31	5.67	11.94	8.13			6.72	15.03
		3		0.00	62.53	9.26	30.17			13.29	22.77
		StdDev		0.00	12.08	11.56	8.36			6.72	15.03
UCR 276-14	Commercial	0	0.75	62.96	0.00	1.85	0.00	0.00	1.85	14.81	16.67
		StdDev	0.19	16.04	0.00	3.21	0.00	0.00	3.21	13.98	14.70
		1		50.00	0.00	5.56	7.41			18.52	20.37
		StdDev		28.87	0.00	5.56	3.21			11.56	11.56
		2	0.35	31.48	12.96	38.89	14.81			22.22	20.37
		StdDev	0.18	27.40	6.42	9.62	6.42			14.70	11.56
		3		31.48	18.52	37.04	25.93			27.78	20.37
		StdDev		27.40	8.49	21.03	11.56			14.70	11.56
UCR 276-14	Tree Ripe	0	0.44	22.22	0.00	5.56	40.74	0.00	5.56	24.07	18.52
		StdDev	0.20	5.56	0.00	5.56	6.42	0.00	0.00	6.42	6.42
		1		18.52	0.00	3.70	40.74			33.33	22.22
		StdDev		3.21	0.00	3.21	6.42			14.70	5.56
		2	0.30	3.70	27.78	37.04	40.74			38.89	22.22
		StdDev	0.10	3.21	11.11	16.97	6.42			11.11	5.56
		3		1.85	35.19	46.30	66.67			48.15	25.93
		StdDev		3.21	8.49	6.42	9.62			17.86	3.21
Panachee	Commercial	0	0.57	78.94	0.00	9.26	0.00	14.35	0.00	0.00	7.64
		StdDev	0.16	5.91	0.00	8.49	0.00	20.24	0.00	0.00	3.03
		1		61.34	0.00	14.81	1.85			8.33	9.72
		StdDev		5.21	0.00	13.98	3.21			14.43	3.67
		2	0.70	17.13	3.94	61.57	1.85			18.75	9.72
		StdDev	0.39	4.88	3.43	5.61	3.21			32.48	3.67
		3		17.13	21.76	55.32	7.87			24.54	9.72
		StdDev		4.88	13.91	10.02	6.85			32.88	3.67
Panachee	Tree Ripe	0	0.27	7.41	1.85	12.96	66.67	25.93	5.56	1.85	9.26
		StdDev	0.06	6.42	3.21	22.45	24.22	8.49	5.56	3.21	6.42
		1		7.41	25.93	18.52	66.67			3.70	9.26
		StdDev		6.42	35.72	19.51	24.22			6.42	6.42
		2	0.27	0.00	42.59	22.22	66.67			5.56	24.07
		StdDev	0.03	0.00	49.79	22.22	24.22			9.62	11.56
		3		0.00	59.26	18.52	68.52			7.41	24.07
		StdDev		0.00	35.28	16.04	22.45			12.83	11.56

Cultivar	Maturity	Days at 20C	Firmness (lb)	Sound (%)	Decay (%)	Beginning decay (%)	Off Color (%)	Growth Cracks (%)	Splits (%)	Juice on ostiole (%)	Blemishes (%)
Orphan	Commercial	0	1.23	64.81	0.00	0.00	29.63	0.00	0.00	3.70	5.56
		StdDev	0.59	12.83	0.00	0.00	8.49	0.00	0.00	3.21	5.56
		1		57.41	0.00	0.00	29.63			5.56	9.26
		StdDev		11.56	0.00	0.00	8.49			5.56	3.21
		2	0.79	35.19	3.70	14.81	48.15			5.56	9.26
		StdDev	0.19	8.49	6.42	8.49	11.56			5.56	3.21
		3		33.33	7.41	29.63	48.15			5.56	14.81
		StdDev		11.11	8.49	3.21	11.56			5.56	8.49
Orphan	Tree Ripe	0	0.36	14.81	0.00	1.85	14.81	0.00	0.00	11.11	31.48
		StdDev	0.07	11.56	0.00	3.21	11.56	0.00	0.00	9.62	11.56
		1		5.56	0.00	7.41	51.85			16.67	31.48
		StdDev		9.62	0.00	8.49	27.96			14.70	11.56
		2	0.57	0.00	11.11	33.33	68.52			25.93	37.04
		StdDev	0.31	0.00	9.62	22.22	16.04			19.51	8.49
		3		0.00	25.93	35.19	70.37			29.63	48.15
		StdDev		0.00	13.98	3.21	17.86			16.97	3.21
Zidi	Commercial	0	0.48	92.59	0.00	0.00	0.00	57.41	35.19	5.56	0.00
		StdDev	0.08	8.49	0.00	0.00	0.00	32.55	16.04	9.62	0.00
		1		51.85	5.56	0.00	0.00			27.78	1.85
		StdDev		13.98	9.62	0.00	0.00			11.11	3.21
		2	0.35	11.11	7.41	46.30	1.85			55.56	5.56
		StdDev	0.09	5.56	8.49	12.83	3.21			14.70	5.56
		3		11.11	31.48	20.37	9.26			66.67	7.41
		StdDev		5.56	25.66	3.21	3.21			9.62	3.21
Zidi	Tree Ripe	0	0.32	9.26	11.11	0.00	1.85	61.11	22.22	9.26	11.11
		StdDev	0.04	8.49	11.11	0.00	3.21	11.11	14.70	11.56	0.00
		1		3.70	40.74	11.11	1.85			20.37	11.11
		StdDev		3.21	22.45	5.56	3.21			13.98	0.00
		2	0.44	1.85	77.78	18.52	1.85			22.22	11.11
		StdDev	0.07	3.21	11.11	8.49	3.21			11.11	0.00
		3		0.00	81.48	9.26	1.85			24.07	11.11
		StdDev		0.00	6.42	3.21	3.21			13.98	0.00
UCR 291	Commercial	0	1.05	46.30	0.00	1.85	7.41	18.52	5.56	40.74	12.96
		StdDev	0.31	19.51	0.00	3.21	8.49	13.98	5.56	12.83	8.49
		1		25.93	1.85	24.07	14.81			62.96	27.78
		StdDev		35.28	3.21	16.04	3.21			27.96	20.03
		2	1.21	18.52	31.48	38.89	22.22			68.52	27.78
		StdDev	0.38	32.08	23.13	14.70	11.11			26.25	20.03
		3		14.81	61.11	24.07	38.89			74.07	27.78
		StdDev		25.66	24.22	3.21	24.22			25.66	20.03
UCR 291	Tree Ripe	0	0.28	0.00	1.85	5.56	70.37	27.78	14.81	50.00	40.74
		StdDev	0.11	0.00	3.21	0.00	16.04	14.70	8.49	20.03	6.42
		1		0.00	31.48	9.26	70.37			66.67	42.59
		StdDev		0.00	19.51	8.49	16.04			33.79	3.21
		2	0.24	0.00	79.63	20.37	70.37			70.37	42.59
		StdDev	0.06	0.00	8.49	8.49	16.04			36.99	3.21
		3		0.00	83.33	14.81	85.19			87.04	42.59
		StdDev		0.00	5.56	3.21	3.21			17.86	3.21

Cultivar	Maturity	Days at 20C	Firmness (lb)	Sound (%)	Decay (%)	Beginning decay (%)	Off Color (%)	Growth Cracks (%)	Splits (%)	Juice on ostiole (%)	Blemishes (%)
Verdal	Commercial	0	1.09	66.11	0.00	2.78	0.00	41.11	2.78	2.78	10.28
ongue		StdDev	0.34	21.10	0.00	4.81	0.00	8.39	4.81	4.81	2.10
		1		52.50	0.00	13.61	6.11			6.11	15.83
		StdDev		16.39	0.00	5.91	5.36			5.36	8.04
		2	0.94	36.11	5.56	34.44	11.67			13.06	15.83
		StdDev	0.47	12.73	9.62	15.03	12.58			3.37	8.04
		3		25.83	9.72	39.72	57.78			16.39	15.83
		StdDev		13.77	8.67	2.10	17.51			3.76	8.04
Verdal Longue	Tree Ripe	0	0.41	33.77	3.70	5.77	13.18	50.98	5.66	9.48	15.36
		StdDev	0.10	10.46	3.21	5.89	3.04	11.24	0.19	3.41	12.48
		1		12.96	11.55	9.48	16.88			15.25	22.98
		StdDev		13.98	10.38	3.41	5.23			7.17	16.00
		2	0.47	1.85	33.77	22.66	26.47			18.95	24.95
		StdDev	0.05	3.21	8.87	11.14	3.77			6.82	19.35
		3		0.00	53.16	22.44	71.68			20.81	30.50
		StdDev		0.00	16.08	10.79	11.15			3.64	15.38
135-4S	Commercial	0	0.80	79.63	0.00	0.00	0.00	9.26	12.96	7.41	3.70
		StdDev	0.19	25.66	0.00	0.00	0.00	3.21	6.42	3.21	6.42
		1		55.56	0.00	12.96	0.00			33.33	11.11
		StdDev		29.40	0.00	11.56	0.00			19.25	14.70
		2	0.45	40.74	5.56	46.30	7.41			38.89	12.96
		StdDev	0.15	26.25	5.56	23.13	12.83			14.70	17.86
		3		38.89	33.33	24.07	37.04			40.74	12.96
		StdDev		29.40	9.62	13.98	21.03			12.83	17.86
35-4S	Tree Ripe	0	0.22	7.41	9.26	20.37	1.85	46.30	12.96	42.59	7.41
		StdDev	0.09	3.21	3.21	13.98	3.21	16.04	8.49	8.49	6.42
		1		0.00	37.04	25.93	31.48			70.37	9.26
		StdDev		0.00	19.51	23.13	26.25			3.21	3.21
		2	0.23	0.00	66.67	29.63	50.00			90.74	22.22
		StdDev	0.04	0.00	11.11	11.56	14.70			3.21	9.62
		3		0.00	88.89	11.11	87.04			96.30	22.22
		StdDev		0.00	5.56	5.56	6.42			3.21	9.62
152-4S	Commercial	0	0.74	66.67	0.00	1.85	0.00	50.00	24.07	7.41	5.56
		StdDev	0.33	5.56	0.00	3.21	0.00	5.56	13.98	6.42	5.56
		1		37.04	5.56	14.81	3.70			33.33	12.96
		StdDev		8.49	0.00	13.98	3.21			9.62	3.21
		2	0.42	16.67	27.78	53.70	7.41			59.26	14.81
		StdDev	0.14	5.56	11.11	11.56	3.21			13.98	3.21
		3		9.26	42.59	44.44	11.11			61.11	14.81
		StdDev		8.49	8.49	14.70	5.56			14.70	3.21
152-4S	Tree Ripe	0	0.33	5.56	7.41	20.37	5.56	59.26	1.85	37.04	14.81
		StdDev	0.10	5.56	6.42	8.49	9.62	11.56	3.21	21.03	8.49
		1		3.70	27.78	24.07	16.67			53.70	16.67
		StdDev		3.21	20.03	11.56	11.11			21.03	11.11
		2	0.22	0.00	59.26	24.07	27.78			74.07	22.22
		StdDev	0.03	0.00	16.97	17.86	5.56			16.97	9.62
		3		0.00	75.93	20.37	64.81			85.19	22.22
		StdDev		0.00	8.49	6.42	17.86			8.49	9.62

Cultivar	Maturity	Days at 20C	Firmness (lb)	Sound (%)	Decay (%)	Beginning decay (%)	Off Color (%)	Growth Cracks (%)	Splits (%)	Juice on ostiole (%)	Blemishes (%)
Kadota 1	Commercial	0	0.75	75.93	0.00	0.00	0.00	5.56	0.00	24.07	3.70
		StdDev	0.46	6.42	0.00	0.00	0.00	9.62	0.00	6.42	6.42
		1		27.78	0.00	29.63	5.56			42.59	7.41
		StdDev		9.62	0.00	8.49	5.56			19.51	6.42
		2	0.47	12.96	5.56	61.11	20.37			55.56	12.96
		StdDev	0.08	3.21	5.56	9.62	8.49			16.67	13.98
		3		11.11	35.19	48.15	20.37			62.96	12.96
		StdDev		0.00	21.03	21.03	8.49			12.83	13.98
Kadota 1	Tree Ripe	0	0.41	27.97	0.00	16.21	3.92	0.00	0.00	41.57	2.22
		StdDev	0.08	21.73	0.00	6.39	6.79	0.00	0.00	21.70	3.85
		1		3.92	22.88	20.65	14.51			59.48	10.07
		StdDev		6.79	14.85	7.86	7.56			10.80	6.58
		2	0.41	0.00	34.64	46.41	18.43			61.44	14.51
		StdDev	0.12	0.00	5.99	11.32	1.36			7.42	7.56
		3		0.00	57.25	38.30	29.02			61.44	18.95
		StdDev		0.00	14.90	17.83	9.51			7.42	13.77
Blanquette	Commercial	0	0.65	24.07	0.00	1.85	18.52	0.00	22.22	70.37	12.96
		StdDev	0.15	12.83	0.00	3.21	8.49	0.00	5.56	22.45	8.49
		1		18.52	0.00	5.56	20.37			81.48	31.48
		StdDev		8.49	0.00	5.56	8.49			13.98	11.56
		2	0.58	14.81	3.70	37.04	35.19			83.33	37.04
		StdDev	0.36	6.42	3.21	19.51	16.04			11.11	8.49
		3		11.11	20.37	44.44	70.37			87.04	37.04
		StdDev		5.56	8.49	11.11	13.98			8.49	8.49
nquette	Tree Ripe	0	0.24	5.56	0.00	5.56	46.30	1.85	27.78	59.26	25.93
		StdDev	0.09	5.56	0.00	0.00	6.42	3.21	0.00	11.56	11.56
		1		0.00	3.70	3.70	48.15			77.78	35.19
		StdDev		0.00	3.21	3.21	8.49			5.56	17.86
		2	0.26	0.00	29.63	35.19	74.07			83.33	38.89
		StdDev	0.13	0.00	13.98	6.42	12.83			11.11	24.22
		3		0.00	61.11	16.67	98.15			87.04	50.00
		StdDev		0.00	20.03	9.62	3.21			11.56	24.22
Ischia Black	Commercial	0	0.81	68.52	0.00	0.00	0.00	0.00	31.48	14.81	0.00
		StdDev	0.25	19.51	0.00	0.00	0.00	0.00	13.98	16.04	0.00
		1		61.11	0.00	0.00	0.00			25.93	0.00
		StdDev		16.67	0.00	0.00	0.00			21.03	0.00
		2	0.49	33.33	3.70	12.96	1.85			55.56	1.85
		StdDev	0.15	22.22	3.21	8.49	3.21			19.25	3.21
		3		24.07	18.52	7.41	1.85			59.26	1.85
		StdDev		27.40	11.56	6.42	3.21			23.13	3.21
Ischia Black	Tree Ripe	0	0.38	51.85	0.00	0.00	0.00	1.85	29.63	14.81	0.00
		StdDev	0.05	6.42	0.00	0.00	0.00	3.21	13.98	8.49	0.00
		1		20.37	3.70	11.11	0.00			16.67	3.70
		StdDev		12.83	6.42	5.56	0.00			11.11	3.21
		2	0.36	11.11	20.37	14.81	0.00			22.22	3.70
		StdDev	0.02	5.56	11.56	8.49	0.00			14.70	3.21
		3		1.85	40.74	16.67	0.00			24.07	3.70
		StdDev		3.21	3.21	11.11	0.00			11.56	3.21

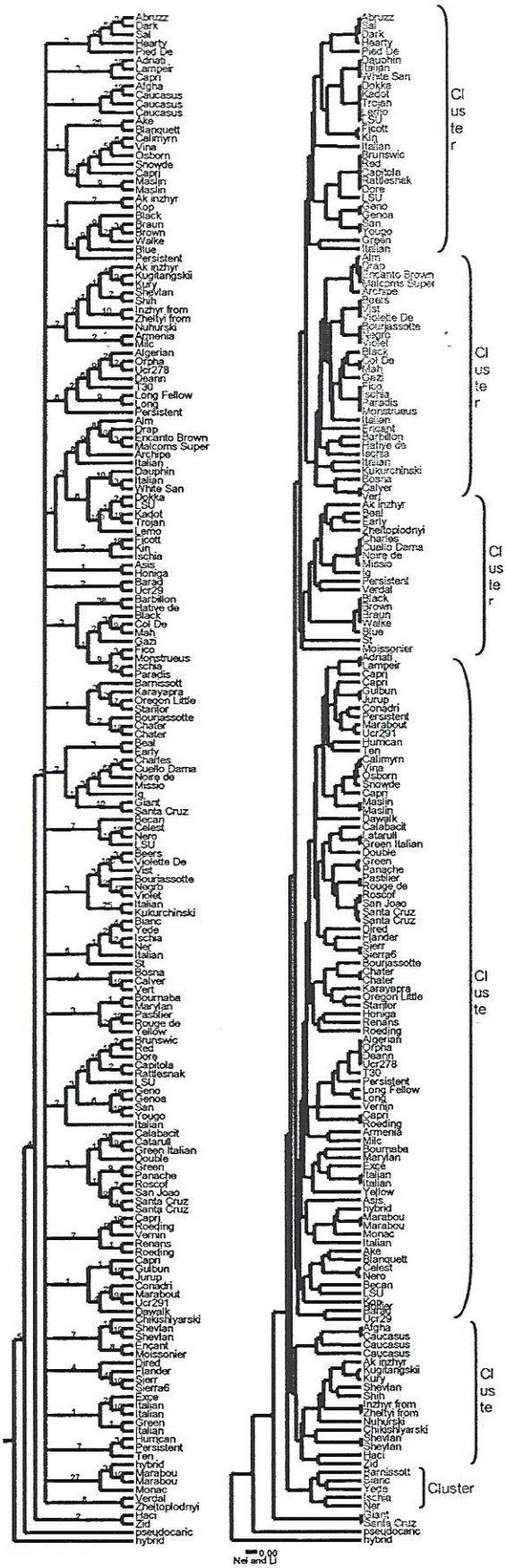
Cluster
Cluster
Cluster
Cluster
Cluster
Cluster
Nei and Li
0.00

Fig. 1